README document for the FLEXPART black carbon aerosol L4 global daily 1 x 1 degrees V1 (BCFLEXPART), available at the GES DISC, https://dx.doi.org://10.5067/XZOC4FV8LV3A.

File naming convention.
FLEXPART_black_carbon_aerosol_L4_global_daily_1x1_degrees_V1_xxxx.nc, where xxxx refers to year, from 2008 to 2015.

Dataset description.

This is a global simulation of black carbon (BC) aerosol concentrations and daily deposition (wet+dry) from the FLEX-ible PARTicle (FLEXPART) Lagrangian particle dispersion model version 10.4 (Pisso et al., 2019) for the years 2008-2015. The FLEXPART model code are open source and freely available at https://www.flexpart.eu/. The source code updates on this web page for FLEXPART version 10.4 are described in Pisso et al. (2019). In the simulations presented here, the model was forced by ERA-Interim meteorological fields from the European Centre for Medium-Range Weather Forecasts (ECMWF) at 1° x 1° spatial and 3-hourly temporal resolution. In addition to dry and wet deposition, FLEXPART accounts for turbulence (Cassiani et al., 2015), unresolved mesoscale motions (A. Stohl et al., 2005) and includes a deep convection scheme (Forster et al., 2007). Gravitational settling, dry deposition and in-cloud and below-cloud scavenging are also included (Grythe et al., 2017).

BC does not chemically age over time or interact with other aerosol types in the model and is assumed to be hydrophilic. BC concentrations were calculated from both anthropogenic emissions (using ECLIPSEv6b) and biomass burning (GFED4.1s (Giglio et al., 2013)), following Klimont et al. (2017) but with updated emissions factors (Z. Klimont, pers. comm.). The tracking of BC particles includes gravitational settling for all spherical particles, and BC aerosols have assumed mean diameters of 0.25 μm, a logarithmic standard deviation of 0.3, and a particle density of 1500 kg m^{-3} (Long et al., 2013). The BC emissions datasets may not include some local sources of combustion aerosols.

Details on FLEXPART Arctic aerosol distributions have been discussed previously (Eckhardt et al., 2015; Groot Zwaaftink et al., 2016; A. Stohl, 2006). Smoke and pollution transport in FLEXPART have been well validated over the Arctic, and various observations suggest that FLEXPART BC can act as a proxy for strong, CALIPSO-detectable aerosol layers (Damoah et al., 2004; Eckhardt et al., 2015; Forster et al., 2001; Paris et al., 2009; Sodemann et al., 2011; Stohl et al., 2002, 2003, 2015; Zamora et al., 2017, 2018).

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Dataset usage. Black carbon aerosol information is at daily 1° x 1° resolution with global coverage between 2008-2015. Corresponding latitudes (-89.5 to 89.5 degrees North) and longitudes (-178.5 to 180.5 degrees East) for grid cell centers are also provided. Black carbon daily wet + dry deposition grids are separated by anthropogenic and biomass burning sources ('Black carbon daily deposition from ANThropogenic sources' and 'Black carbon daily deposition from Biomass Burning', respectively). Black carbon concentration grids have upper vertical layer boundaries of 10, 100, 250, 500, 750, 1000, 1500, 2000, 4000, 6000, 8000, 10,000, 15,000, and 20,000 m above ground level and are also separated by anthropogenic and biomass burning sources ('Daily Black Carbon concentrations from ANThropogenic sources' and 'Daily Black Carbon concentrations from Biomass Burning', respectively).

Dataset availability. Black carbon deposition and concentrations for anthropogenic and biomass burning sources from 2008-2015 are available from the Goddard Earth Sciences Data and Information Services Center (GES DISC; https://dx.doi.org://10.5067/XZOC4FV8LV3A).

Dataset variables:

- **latitude** an array of latitude centers from -89.5 to 89.5 with each center corresponding to a row of the concentration and deposition grids. Units are degrees north. Dimensions: [180].
- **longitude** an array of longitude centers from -178.5 to 180.5 with each center corresponding to a column of the concentration and deposition grids. Units are degrees east. Dimensions: [360].
- **altitude** an array of upper vertical layer boundaries of 10, 100, 250, 500, 750, 1000, 1500, 2000, 4000, 6000, 8000, 10000, 15000, and 20000 m. Units are meters above ground level. Dimensions: [14].
- **time** an array of time values. Units are days since 1970-01-01 00:00 UTC. Dimensions: [either 365 or 366, depending on the number of days in the year].
- **BC_depo_ANT, BC_depo_BB** black carbon wet + dry daily deposition rate grids at 1° x 1° resolution for anthropogenic and biomass burning sources, respectively. Units are ng m^{-2}. Each grid has global spatial coverage with grid cell centers from -89.5 to 89.5 degrees north latitude and -178.5 to 180.5 degrees east longitude. Dimensions: [360,

180, 365] or [360, 180, 366] depending on the time array length for each year.

- **BC_conc_ANT, BC_conc_BB** black carbon concentration grids at 1° x 1° horizontal resolution and upper vertical layer boundaries of 10, 100, 250, 500, 750, 1000, 1500, 2000, 4000, 6000, 8000, 10,000, 15,000, and 20,000 m above ground level for anthropogenic and biomass burning sources, respectively. Units are ng m^{-3}. Each grid has global spatial coverage with grid cell centers from -89.5 to 89.5 degrees north latitude and -178.5 to 180.5 degrees east longitude. Dimensions: [360, 180, 14, 365] or [360, 180, 14, 366] depending on the time array length for each year.

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